

High Voltage Braced Insulator Assemblies

Design & Application

Panel Session PN23

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High Voltage Braced Insulator Assemblies

Design & Application

A. C. Baker: *Overview & general comments*

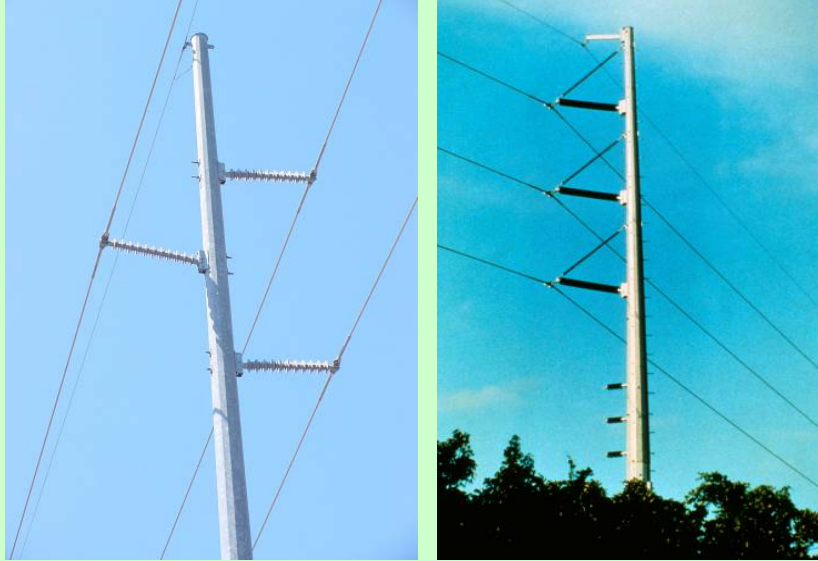
R. A. Bernstorf: *Strength ratings*

D. G. Powell: *Horizontal Vee stability*

R. K. Kihara: *Construction*

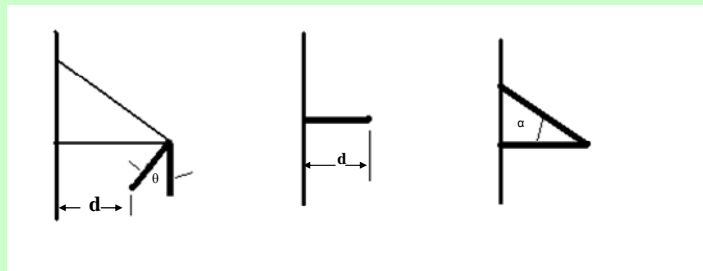
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Armless Construction



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Load Capacity Improvement



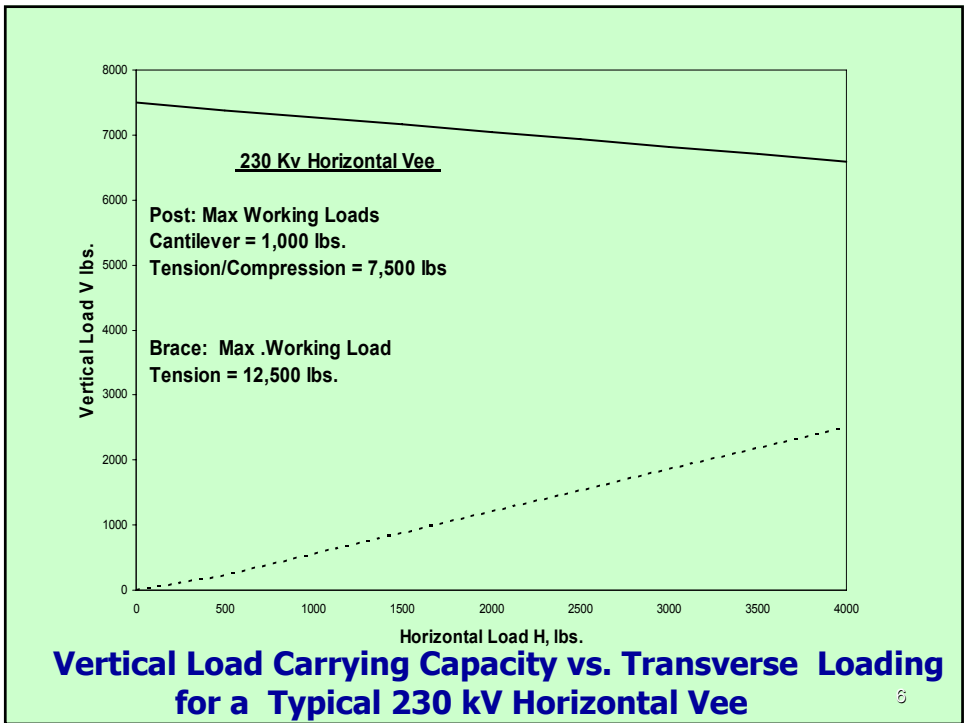
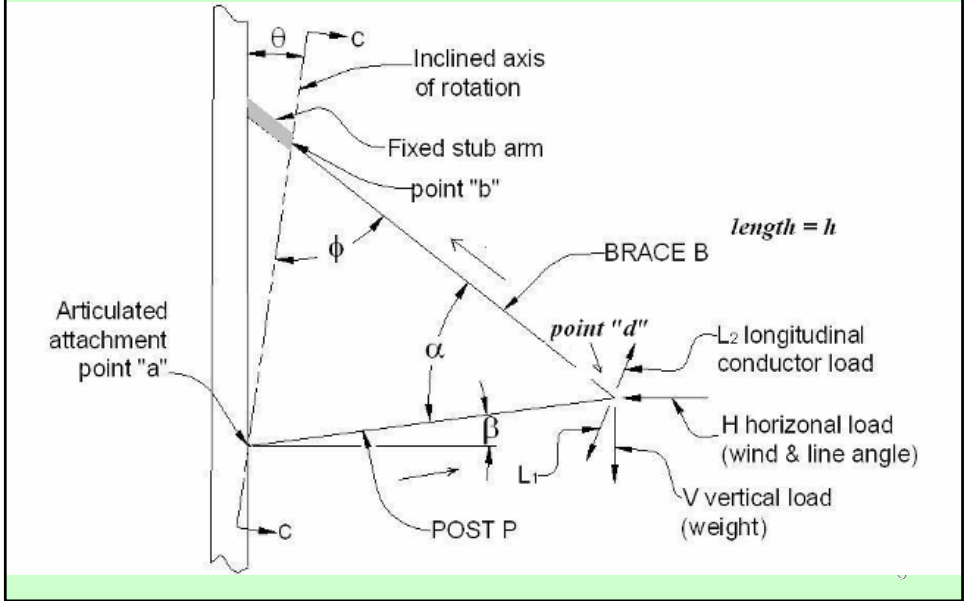
Maximum Allowable Vertical (Weight) Load

	<u>Conventional Vertical String</u>	<u>Horizontal Line Post</u>	<u>Braced Post Assembly</u>	
Porcelain	RTL (RTL = 0.5 M&E)	RCL (RCL = 0.4CS)	For $\alpha = 45^\circ$.707 RTL	For $\alpha = 30^\circ$.500 RTL
Polymer	RTL (RTL = 0.5 SML)	RCL (RCL = 0.5 SCL)		
	<u>RTL range</u> 7,500 - 25,000 lbs.	<u>RCL range</u> 650 - 1,900 lbs.	<u>V_{MAX} range</u> 2,500 - 14,000 lbs.	

REFERENCES: 1) ANSI C29 STANDARDS, (C29.2, 29.7, C29.12, & C29.17)
2) IEEE STANDARD 987, "IEEE Guide for Application of Composite Insulators"
3) NEMA STANDARD PUB. HV-2, "Application Guide for Ceramic Insulators"

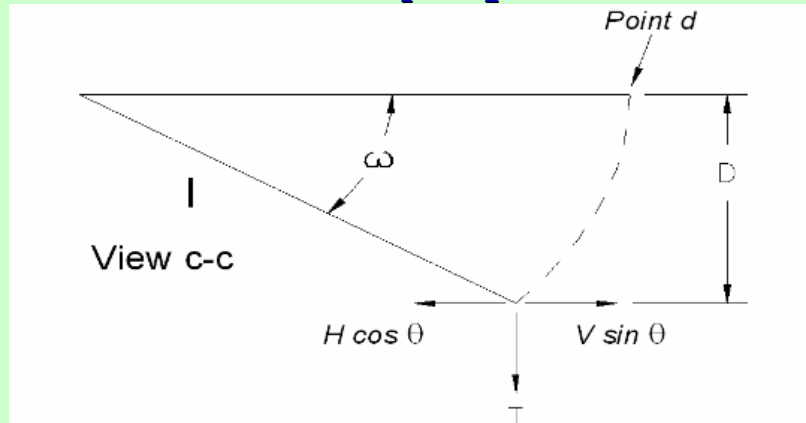
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Braced Insulator Assembly



Unbalanced Longitudinal Loads

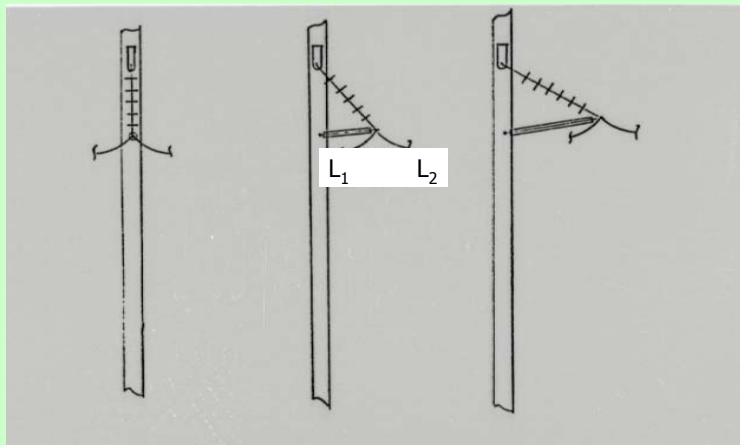
$$L_1 \neq L_2$$



$$T = (V \sin \theta - H \cos \theta) \tan \omega$$

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Horizontal Vee Longitudinal Displacement



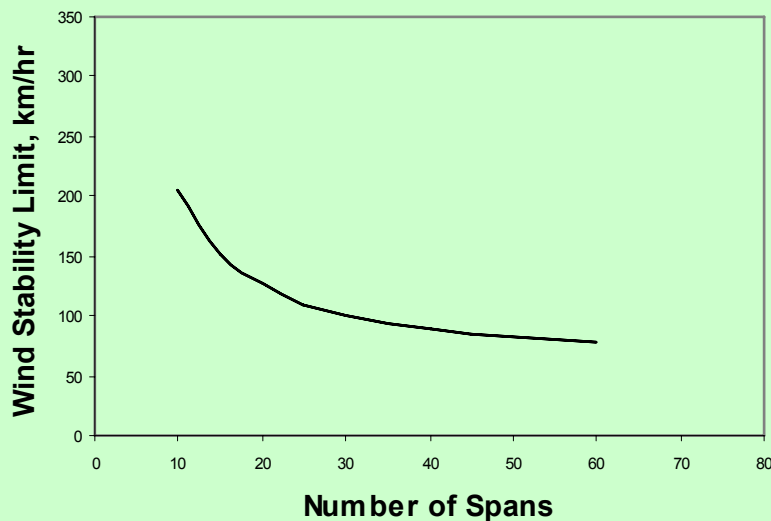
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Horizontal Vee Lines

- **Wind stability limit can be lower than maximum wind speed usually considered.**
- **HV assemblies subjected to unbalanced longitudinal loads will be displaced in direction of higher load.**
- **Changes in sag will counteract the unbalancing load, establishing new equilibrium at each support point.**
- **Iterative solution needed.**

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Horizontal Vee Wind Speed Stability Limit



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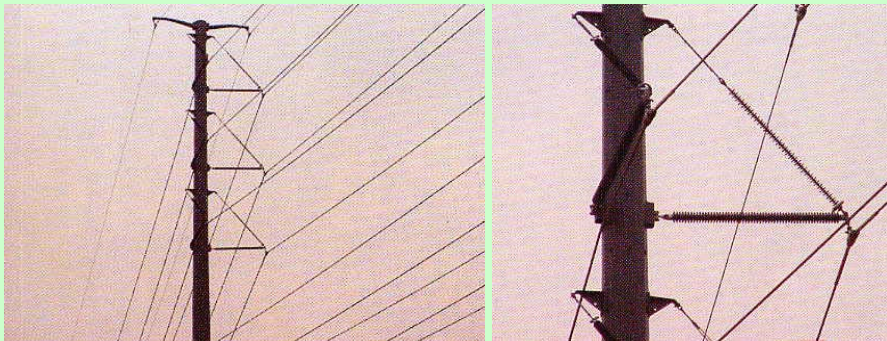
230 kV Horizontal Vee Line



Ref. INMR Quarterly Review Quarter 1 2004

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Rotated Horizontal Vee



Ref. INMR Quarterly Review Quarter 1 2004

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Braced Post Used as a Longitudinal Restraint Point



Ref. INMR Quarterly Review Quarter 1 2004

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Tripod Longitudinal Restraint Assembly



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Other Loading Considerations

- **Suspension insulators: tension loads only.**
- **Brace: no compression loads.**
- **Polymer posts: combined loading effects**
- **Some Porcelain posts designed for tension /compression only.
Do not use for Braced Post Assemblies.**
- **Posts : consider buckling strength**
- **These subjects will be covered in detail in later presentations.**

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Electrical Design

- **Brace and Post insulator components must be properly coordinated.**
- **Individual components must be adequate to withstand the power frequency and impulse electrical stresses in service.**
- **Assembly Leakage Distance.**
- **Assembly Dry Arc Distance.**
- **Manufacturers should be consulted concerning need for corona rings.**

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Summary

- **Two types of Braced Insulator Assemblies:
Braced Posts & Horizontal Vees
(fixed or articulated posts)**
- **Different mechanical characteristics.**
- **Braced Posts primarily polymer.**
- **Consider Horizontal Vee wind stability limits.**
- **Longitudinal restraint assemblies can increase the wind stability limit for a Horizontal Vee line.**
- **Installation of some Horizontal Vees may require special construction techniques.**

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